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AUTHOR Trent, John H.
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ABSTRACT

Two questionnaires were given to a random sample of rural and urban elementary and secondary teachers as well as to mathematics methods students at the University of Nevada. The questionnaires were used to determine (1) the need for inservice and preservice metric education and (2) the present knowledge of the metric system of Nevada teachers. The data indicated: (1) a need for inservice metric workshops for both rural and metropolitan elementary levels, (2) the need is not as great for workshops at junior and senior high levels, (3) elementary mathematics methods students are not adequately prepared in the metric system, and (4) secondary mathematics methods students and junior and senior high teachers are more adequately prepared in the metric system than their elementary counterparts. This paper suggests a workshop for secondary teachers and recommends that a more relevant and comprehensive questionnaire be prepared to verify the need for a workshop. (JBW)

NEED FOR IN-SERVICE AND PRE-SERVICE METRIC EDUCATION

by

Dr. John H. Trent
University of Nevada
Reno, Nevada

A survey was conducted in February 1975 in order to determine the present knowledge of the metric system of Nevada teachers and to determine whether or not there is a need for in-service workshops for these teachers.

In order to obtain the desired information, two questionnaires were sent to a random sample of in-service elementary and secondary teachers in Nevada. These same questionnaires were also administered to both elementary and secondary (pre-service) methods students at the University of Nevada, Reno. The data obtained from the first questionnaire is shown in Table I below.

TABLE I

NEED FOR METRIC WORKSHOP QUESTIONNAIRE

1. Have you had a college course in which the metric system was taught or used?

	Yes	No
(a) Elementary Teachers		
1. Rural population	25(20.5%)	97(79.5%)
2. Large population	38(26.2%)	107(73.8%)
3. Medium population	14(13.7%)	88(86.3%)
(b) Junior High Teachers	33(51.5%)	31(48.5%)
(c) High School Teachers	49(66.2%)	25(33.8%)
(d) Elementary Math Methods Students	7(16.3%)	36(83.7%)
(e) Secondary Math Methods Students	13(76.5%)	4(23.5)

Chi Sqd = 91.9426 Sign Level= .001

2. Do you feel qualified to teach arithmetic (or science) courses in which the metric system is taught or used?

	Yes	No
(a) Elementary Teachers		
1. Rural population	27(21.1%)	101(78.9%)
2. Large population	39(27.5%)	103(72.5%)
3. Medium population	19(18.8%)	82(81.2%)
(b) Junior High Teachers	33(58.9%)	23(41.1%)
(c) High School Teachers	54(74%)	19(26%)
(d) Elementary Math Methods Students	2(4.5%)	42(95.4%)
(e) Secondary Math Methods Students	9(52.9%)	8(47.1%)

Chi Sqd.=106.782 Sign Level= .00

3. Did you know that in 1974 Congress passed a law stating the " education systems should be encouraged to provide metric education for students?

	Yes	No
(a) Elementary Teachers		
1. Rural population	98(80.3%)	24(19.7%)
2. Large population	120(85.1%)	21(14.9%)
3. Medium population	89(86.4%)	14(13.2%)
(b) Junior High Teachers	50(80.6%)	12(19 4%)
(c) High School Teachers	58(77.3%)	17(22.7%)
(d) Elementary Math Methods Students	26(17.2%)	18(41%)
(e) Secondary Math Methods Students	12(70 6%)	5(29 4%)

Chi Sqd.= 85.4856 Sign Level= .001

4. Did you know that the Nevada State Textbook Commission has recommended that all textbooks adopted after January 1, 1976 have the metric system as the primary system of measurement?

	Yes	No
(a) Elementary Teachers		
1. Rural population	69(52.7%)	62(47.3%)
2. Large population	68(48.2%)	73(51.8%)
3. Medium population	70(69.3%)	31(30.7%)
(b) Junior High Teachers	23(37.1%)	39(62.9%)
(c) High School Teachers	37(49.3%)	38(50.7%)
(d) Elementary Math Methods Students	8 (17.2%)	36(71.8%)
(e) Secondary Math Methods Students	3 (16.7%)	15(83.3%)

Chi Sqd.= 51.5339 Sign Level= .001

5. How adequately prepared in the metric system are students when they commence the school year in your class?

	Very well Prepared	Fairly well Prepared	Inadequately Prepared	Not Prepared
(a) Elementary Teachers.				
1. Rural population	0(0%)	2(12.5%)	25(29.4%)	100(38%)
2. Large population	0(0%)	9(56.2%)	35(41.2%)	90(34.2%)
3. Medium population	0(0%)	5(31.3%)	25(29.4%)	73(27.8%)
(b) Junior High Teachers	0(0%)	6(9.5%)	34(47.2%)	23(36.5%)

	Very well Prepared	Fairly well Prepared	Inadequately Prepared	Not Prepared
(c) High School Teachers	0(0%)	6(8.1%)	39(52.5%)	29(39.2%)
(d) Elementary Math Methods Students	2(6.7%)	3(10%)	12(40%)	13(43.3%)
(e) Secondary Math Methods Students	0(0%)	1(8.3%)	9(75%)	2(16.7%)

Chi Sqd.= 84.6902 Sign level= .001

6. How much are you now teaching the metric system to your students?

	A Lot	A Little	None At All
(a) Elementary Teachers			
1. Rural population	4(33.3%)	77(37.4%)	47(32.2%)
2. Large population	5(41.7%)	83(40.3%)	54(37%)
3. Medium population	3(25.0%)	46(22.3%)	45(30.8%)
(b) Junior High Teachers	10(16.1%)	41(66%)	11(17.8%)
(c) High School Teachers	25(33.3%)	39(52%)	11(14.7%)
(d) Elementary Math Methods Students	2(6.7%)	4(13.3%)	24(80%)
(e) Secondary Math Methods Students	5(29.4%)	9(52.9%)	3(17.7%)

Chi Sqd.=110.223 Sign level= .001

7. If a federally funded in-service course in metric education were offered by the University of Nevada, Reno, would you attend it?

A. If it were in your county:	Yes	No
(a) Elementary Teachers		
1. Rural population	125(96.2%)	5(3.8%)
2. Large population	122(87.1%)	18(12.9%)
3. Medium population	82(88.2%)	11(11.8%)
(b) Junior High Teachers	51(85%)	8(15%)
(c) High School Teachers	62(87.3%)	8(12.7%)
(d) Elementary Math Methods Students	31(75.6%)	10(24.3%)
(e) Secondary Math Methods Students	10(62.5%)	6(37.5%)

Chi Sqd.=52.3499 Sign level= .001

B. If it were offered on the University of Nevada, Reno campus:	Yes	No
(a) Elementary Teachers		
1. Rural population	34(33%)	69(67%)
2. Large population	9(7.8%)	106(92.2%)
3. Medium population	75(84.3%)	14(15.7%)
(b) Junior High Teachers	26(49.1%)	27(50.9%)
(c) High School Teachers	29(55.8%)	23(44.2%)
(d) Elementary Math Methods Students	35(83.3%)	7(16.7%)
(e) Secondary Math Methods Students	15(100%)	0(0%)

Chi Sqd.=48.1507 Sign level= 4

8. How great is the need for placing more emphasis on the metric system in elementary mathematics classes?

	Very Great	Needed Somewhat	No Need
(a) Elementary Teachers			
1. Rural population	75(35.7%)	41(30.6%)	3(37.5%)
2. Large population	74(35.2%)	55(41.0%)	3(37.5%)
3. Medium population	61(29.1%)	38(28.4%)	2(25.0%)
(b) Junior High Teachers	36(60%)	22(36.7%)	2(3.3%)

	Very Great	Needed Somewhat	No Need
(c) High School Teachers	45(62.59%)	26(36.1%)	1(1.4%)
(d) Elementary Math Methods Students	28(59.6%)	8(22.2%)	0(0%)
(e) Secondary Math Methods Students	14(82.4%)	3(17.6%)	0(0%)
	Chi Sqd.= 6.2381	Sign level= n.s.	

9. Do you fell that adequate guidelines, course outlines and materials on the metric system are available to you for satisfactorily teaching the metric system to your students?

	Yes	No
(a) Elementary Teachers		
1. Rural population	13(10.6%)	110(89.4%)
2. Large population	26(21%)	98(79%)
3. Medium population	28(29.5%)	67(70.5%)
(b) Junior High Teachers	16(27.6%)	42(72.4%)
(c) High School Teachers	26(36.1%)	46(63.9%)
(d) Elementary Math Methods Students	7(21.2%)	26(78.8%)
(e) Secondary Math Methods Students	8(66.7%)	4(33.3%)
	Chi Sqd.= 19.6604	Sign level= .001

The primary emphasis of the first analysis of questionnaires was to determine if the need for metric workshops for elementary teachers of Nevada was confined to a specific geographic area such as rural or metropolitan (medium and large population) counties. An analysis of the data indicated the following:

a. In rural and metropolitan counties (medium and large populations) most elementary teachers had not had a college course in the metric system.

b. Most of the elementary teachers of Nevada participating in this survey did not feel qualified to teach an arithmetic or science course in which the metric system was taught or used.

c. Rural counties indicated students were inadequately prepared in the metric system.

d. Rural and metropolitan elementary teachers agreed they would attend an in-service metric workshop if offered in their county.

e. A majority of both rural and metropolitan elementary teachers did not feel adequate guidelines, course outlines and materials were available to them for teaching the metric system in their classroom.

An inference which may be drawn from this analysis is that there is a need for in-service workshops on the metric system by both rural and metropolitan (medium and large population) elementary teachers of Nevada, as almost all teachers indicated they would attend an in-service metric workshop if offered in their home county.

A second questionnaire was administered simultaneously with the first questionnaire. This was administered to determine the present knowledge and ability of these elementary teachers from rural and metropolitan areas of Nevada on the metric system. The questions and responses to this questionnaire are in Table II.

TABLE II

KNOWLEDGE OF METRIC SYSTEM QUESTIONNAIRE

1. The average lineman in the National Football League weighs:

____ a. 15 kilograms
____ b. 115 kilograms
____ c. 225 kilograms
____ d. 325 kilograms
____ e. 425 kilograms

	Correct Responses	Incorrect Responses
(a) Elementary Teachers		
1. Rural population	53(39.5%)	81(60.5%)
2. Large population	63(44.4%)	79(55.6%)
3. Medium population	52(51.5%)	49(48.5%)
(b) Junior High Teachers	46(76.7%)	14(23.3%)
(c) High School Teachers	61(81.3%)	14(18.7%)
(d) Elementary Math Methods Students	10(22.7%)	34(77.3%)
(e) Secondary Math Methods Students	10(55.6%)	8(44.4%)
	Chi Sqd.=63.8386	Sign level= .001

2. The height of the average American male:

____ a. 1.85 centimeters
____ b. .185 meters
____ c. 1.85 meters
____ d. 18.5 meters
____ e. 18.5 centimeters

	Correct Responses	Incorrect Responses
(a) Elementary Teachers		
1. Rural populations	70(52.2%)	64(47.8%)
2. Large populations	81(57%)	61(43%)
3. Medium populations	57(56.4%)	44(43.1%)
(b) Junior High Teachers	54(90%)	6(10%)
(c) High School Teachers	72(97.3%)	2(2.7%)
(d) Elementary Math Methods Students	23(53.3%)	21(47.7%)
(e) Secondary Math Methods Students	17(94.4%)	1(5.6%)
	Chi Sqd.= 74.2558	Sign level= .001

3. The Average American car gasoline tank holds:

____ a. 80 liters
____ b. 180 liters
____ c. 8 liters
____ d. .8 liters
____ e. 1800 liters

	Correct Responses	Incorrect Responses
(a) Elementary Teachers		
1. Rural populations	69(51.1%)	66(48.9%)
2. Large populations	80(56.3%)	62(43.7%)
3. Medium populations	57(56.4%)	44(43.1%)
(b) Junior High Teachers	47(78.3%)	13(21.7%)
(c) High School Teachers	69(90.8%)	7(9.2%)
(d) Elementary Math Methods Students	11(25%)	33(75%)
(e) Secondary Math Methods Students	10(55.6%)	8(44.4%)
	Chi Sqd.= 64.5355	Sign level= .001

4. Match the below numbers to the letters:

_____	a. meter	1.	.001 meter
_____	b. centimeter	2.	.01 meter
_____	c. millimeter	3.	39.37 inches
_____	d. kilometer	4.	.1 meter
_____	e. decimeter	5.	1000 meter

	Correct Responses	Incorrect Responses
(a) Elementary Teachers		
1. Rural populations	68(54.7%)	56(45.2%)
2. Large populations	83(58.5%)	59(41.5%)
3. Medium populations	63(62.4%)	38(37.6%)
(b) Junior High Teachers	53(88.3%)	7(11.7%)
(c) High School Teachers	68(90.7%)	7(9.3%)
(d) Elementary Math Methods Students	15(34%)	29(66%)
(e) Secondary Math Methods Students	14(77.8%)	4(22.2%)
	Chi Sqd.= 60.9165	Sign level= .001

5. The temperature on a hot day in central Nevada is about:

_____ a. 27° Celsius
_____ b. 212° Celsius
_____ c. 37° Celsius
_____ d. 100° Celsius
_____ e. 47° Celsius

	Correct Responses	Incorrect Responses
(a) Elementary Teachers		
1. Rural populations	24(17.9%)	110(82.1%)
2. Large populations	22(15.5%)	120(84.5%)
3. Medium populations	20(19.8%)	81(80.2%)
(b) Junior High Teachers	26(43.3%)	34(56.7%)
(c) High School Teachers	37(50%)	37(50%)
(d) Elementary Math Methods Students	4(9%)	40(91%)
(e) Secondary Math Methods Students	8(44.4%)	10(55.6%)
	Chi Sqd.= 37.3975	Sign level= .001

6. What does MKS stand for?

	Correct Responses	Incorrect Responses
(a) Elementary Teachers		
1. Rural populations	5(3.8%)	128(96.2%)
2. Large populations	4(2.8%)	138(97.2%)
3. Medium populations	3(3%)	98(97%)

	Correct Responses	Incorrect Responses
(b) Junior High Teachers	9(15%)	51(85%)
(c) High School Teachers	34(46.6%)	39(53.4%)
(d) Elementary Math Methods Students	0(0%)	44(100%)
(e) Secondary Math Methods Students	4(22.2%)	14(77.8%)

Chi Sqd.= 131.455 Sign level= .001

7. What does SI stand for?

	Correct Responses	Incorrect Responses
(a) Elementary Teachers		
1. Rural populations	5(3.8%)	128(96.2%)
2. Large populations	0(0%)	142(100%)
3. Medium populations	6(5.9%)	95(94.1%)
(b) Junior High Teachers	6(10%)	54(90%)
(c) High School Teachers	21(28%)	54(72%)
(d) Elementary Math Methods Students	0 (0%)	44(100%)
(e) Secondary Math Methods Students	2(11.1%)	16(88.9%)

Chi Sqd.= 63.4844 Sign level=.001

With respect to elementary teachers, the responses to these questions indicated:

a. Even though teachers from metropolitan areas did somewhat better, there was no significant difference between the rural and metropolitan (medium and large population) county elementary teachers in their knowledge and ability on the questions related to meters, kilograms and liters.

b. Most of the rural and metropolitan (medium and large population) county elementary teachers were unable to respond correctly to the questions related to Celsius temperature and the meaning of MKS and SI.

The inferences to be drawn from this data concur with the previous conclusion that there is a need for in-service metric workshops for Nevada elementary teachers from both rural and metropolitan counties, even though the teachers from the metropolitan areas showed a somewhat greater knowledge of the metric system.

A comparison between responses made by teachers at different levels indicated:

a. Most elementary teachers of Nevada had not taken a college course in the metric system. However, a majority of both the junior high and senior high teachers had taken such a course.

b. In comparison to junior and secondary teachers of Nevada, most elementary teachers of Nevada felt less qualified to teach the metric system.

c. Nevada elementary teachers were more aware that the Nevada State Textbook Commission had recommended that all textbooks adopted after January 1, 1976, have the metric system as the primary system of measurement.

d. A majority of Nevada teachers on all levels (elementary, junior high and high school) felt that students were inadequately prepared in the

metric system.

e. Approximately 80% of the elementary teachers felt there were not adequate guidelines, course outlines and materials on the metric system available to them to adequately teach their students the metric system, whereas only 40% of the junior high and high school teachers believed that there were no sufficient guidelines, course outlines and materials available to them.

f. Over 85% of Nevada teachers would attend an in-service metric workshop if held in their county. However, only about half of the teachers said they would attend a metric workshop if held on the University of Nevada, Reno campus.

From this questionnaire, the following inference may be drawn: while there is definitely a need for in-service metric workshops for elementary teachers of Nevada, the need is not nearly as great at the junior and senior high school levels.

Analysis of data at various levels showed:

a. Most of the elementary teachers of Nevada responded correctly to questions related to meters, kilograms and liters. The majority of the secondary and junior high teachers of Nevada responded correctly to these same questions related to meters, kilograms and liters.

b. On the question related to Celsius temperature, 76.4% of the elementary teachers of Nevada responded incorrectly, as compared to 50% of the secondary and junior high teachers.

c. The majority of elementary, junior high and senior high school teachers responded incorrectly to questions related to SI and MKS. These differences strengthen the conclusion that elementary teachers of Nevada need in-service metric workshops. In addition, they show that there is

some need for an in-service metric workshop for junior high and secondary teachers.

A comparison of the data obtained from elementary math methods (pre-services) students and the elementary in-service teachers of Nevada showed:

a. The majority of the elementary math methods (pre-service) students of the University of Nevada, Reno had never had a college course in the metric system. This compared to 79.1% of the elementary teachers of Nevada, who indicated they had not had a college course in the metric system.

b. A majority of the elementary math methods (pre-service) students of the University of Nevada, Reno as compared to 77.9% of the elementary teachers of Nevada did not feel qualified to teach a course in arithmetic or science in which the metric system was used.

c. Over three-fourths of the elementary in-service teachers and pre-service methods students did not feel adequate guidelines, course outlines and materials on the metric system were available to them to satisfactorily teach the metric system in their classrooms.

d. Most of the elementary math methods (pre-service) students of the University of Nevada, Reno and the majority of elementary teachers of Nevada agreed that they would attend an in-service metric workshop if offered in their own county.

Inferences drawn from these responses indicate that: (1) The elementary math methods (pre-service) students are not adequately prepared in the metric system. (2) There is a possible need to upgrade the elementary methods curriculum at the University of Nevada, Reno to provide a better basic foundation in the metric system. (3) This lack of adequate metric preparation supports the belief that there is a great need for in-service metric workshops for Nevada elementary teachers.

A comparison of metric knowledge of in-service and pre-service teachers indicated:

a. There was no significant difference in the responses given by elementary teachers and elementary methods students with respect to the questions relating to knowledge of the metric lengths and weights.

b. The majority of the elementary math methods students and elementary teachers responded incorrectly to the question related to Celsius temperature.

c. 100% of the elementary math methods students of the University of Nevada, Reno responded incorrectly to the questions related to SI and MKS. The majority of elementary teachers of Nevada responded incorrectly to these same questions related to SI and MKS.

From these responses, the inferences below might be drawn:

a. The elementary math methods students did not have adequate knowledge of the metric system.

b. In comparison, elementary teachers of Nevada demonstrated a knowledge of meters, liters and kilograms, basic metric knowledge; however, both elementary teachers of Nevada and elementary math methods students of the University of Nevada, Reno were unable to respond correctly to questions related to Celsius temperature, SI and MKS. Therefore, elementary teachers of Nevada and elementary math methods students of the University of Nevada were not able to think in "metric terms."

c. The responses further substantiate the great need for in-service metric workshops for elementary teachers of Nevada and possible the great need for in-service workshops for elementary math methods students of the University of Nevada, Reno.

A comparison of the needs of secondary pre-service and in-service teachers indicated:

a. Some of the junior high and secondary teachers of Nevada did not have a college course in the metric system. Only 23.5% of secondary math methods students of the University of Nevada, Reno did not have a significant college course in the metric system.

b. Approximately two-thirds of the junior high and secondary teachers of Nevada and secondary math methods students did not feel qualified to teach an arithmetic or science course in which the metric system was taught or used.

c. The majority of the secondary and junior high teachers of Nevada and most of the secondary math methods students of the University of Nevada, Reno did not feel adequeate guidelines, course outlines or materials on the metric system were available to satisfactorily teach the metric system in their classrooms.

d. The majority of the secondary math methods students of the University of Nevada, Reno and of junior high and secondary teachers of Nevada agreed they would attend an in-service metric workshop if offered in their counties.

Inferences drawn from these responses are that secondary math methods students of the University of Nevada, Reno and junior high and secondary teachers of Nevada are possibly more adequately prepared in the metric system. There is possibly a need for an in-service metric workshop for the junior high and secondary teachers of Nevada as the majority indicated they would attend a metric workshop if offered.

A comparison of knowledge of metric system of pre-service and in-service teachers indicated:

a. The majority of secondary math methods students of the University of Nevada, Reno and a majority of junior high and secondary teachers of Nevada responded correctly to questions related to meters, kilograms and liters.

b. Most of the secondary math methods students of the University of Nevada, Reno and most of the junior and secondary teachers of Nevada responded correctly to the question related to Celsius temperature.

c. There was a significant difference between junior high teachers and secondary math methods student responses on questions relating to SI and MKS.

The inferences drawn from these responses are that secondary math methods students of the University of Nevada, Reno and junior high and secondary teachers of Nevada had a knowledge of the metric concepts of liters, kilograms and meters; however, each sample group was unable to respond to the questions on SI and MKS and were therefore unable to think in "metric terms." This study further substantiates that there is a need for metric worshops for secondary math methods students of the University of Nevada, Reno and for junior high and secondary teachers of Nevada; however, this need was probably not as great as the need for in-service metric workshops for the elementary teachers of Nevada and elementary math methods students of the University of Nevada, Reno. The data further indicates that secondary math methods students of the University of Nevada, Reno and junior high and secondary teachers of Nevada were more adequately prepared in the metric system as there was a 40% higher correct response level than recorded for the elementary teachers of Nevada and elementary math methods students of the University of Nevada, Reno.

In general, one may conclude from the comparative studies that there is a great need for metric workshops for elementary teachers of Nevada and groups of elementary teachers who have similar characteristics. Thus more emphasis on metric education should be incorporated into the elementary math methods programs. Even though the greatest need is for metric in-service workshops for elementary teachers of Nevada located in rural counties, there is a need for metric education for all elementary teachers. The surveys showed that Nevada junior high and secondary math teachers have a better knowledge of the metric system. However, it is felt that because the questions asked were quite basic and not even 75% of the secondary teachers could answer most of these simple questions, they could profit from a metric workshop. It is recommended that a relevant comprehensive questionnaire be prepared and administered to secondary math and science teachers in order to verify this suspected need. A further implication of this survey may be that teachers feel unqualified to use metric materials that are already available to them. If they were able to attend metric workshops, they might better be able not only to utilize metric materials that are already available to them but to wisely select from the wide variety of metric materials which will become available to them in the future.